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EXAMINER
HORN, ROBERT WAYNE

ART UNIT	PAPER NUMBER
2837	

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Please find below and/or attached an Office communication concerning this application or proceeding.

N·A

Office Action Summary	Application No.	Applicant(s)	
	10/655,341	COCCONI, ALAN GIOVANNI	
	Examiner	Art Unit	
	Robert W. Horn	2837	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 29 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-29 is/are rejected.

7)☒ Claim(s) 1,13 and 25-30 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 04 September 2003 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference characters "100, 101, and 102" have been used to designate the input terminals of Figure 7, Figure 8, and Figure 9. Reference character "103" has been used to designate the terminals of both Figure 7 and Figure 8. Reference characters "64, 65, and 566" have been used to designate both the connections between the inverters and transformers in Figure 4 and the waveform impressed on the connections in Figure 5. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

The numbering of claims is not in accordance with 37 CFR 1.126 which requires the original numbering of the claims to be preserved throughout the prosecution. When claims are canceled, the remaining claims must not be renumbered. When new claims are presented, they must be numbered consecutively beginning with the number next following the highest numbered claims previously presented (whether entered or not).

Misnumbered claims 25-30 have been renumbered 24-29.

Claims 1, 13 and 25 are objected to because of the following informalities: Variables M and N have not been defined and are used in place of values or a range of values. Appropriate correction is required.

Claim 16 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim, or amend the claim to place the claim in proper dependent form, or rewrite the claim(s) in independent form. As regards claim 16, the claim is dependent on (has all the limitations of) claim 15, which is dependent on 14. M is already defined as 3 and is therefore identical to claim 16.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 23, 24, 26 and 27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claims contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 23 describes a transformer that "multiplies the switching frequency associated with an output of the subphases by N. The transformer does average the voltage and sum the currents of the subphases, but does not multiply. Claim 23 does

not include specify any phase differential between the N subphases and does not specify a switching frequency that drives a pulse width modulated (PWM) signal. The disclosure of paragraph 64 of the Specifications depends on a phase differential in the subphases, a switching frequency and an implementation of PWM. The transformer then combines the signals of the N subphases and the resultant output can be N times the switching frequency. The term multiplies the switching frequency otherwise does not make sense.

Claim 24 describes a transformer that "divides the maximum voltage step associated with the output of the subphases by N. This claim depends on claim 23 and subject matter not included in the parent claim 13. In addition, the term divides could be construed to mean "steps down." In the specification, the function of the transformer is described as "averaging voltage" and "summing current." The term "divides" is not synonymous with "averages" and fails to distinctly claim the subject matter disclosed in the specification.

In regard to Claim 26, Figure 3 and paragraphs 21-36 teach the synthesis of polyphase sinusoidal AC voltages. This provides suitable drive for an AC induction motor. A brushless DC (BLDC) motor includes permanent magnets on the rotor and is driven through commutated DC signals driving the stator coil in proper phase relationship. The typical drive for a single phase of the stator coils is a square wave. (This resembles the signal driving a DC motor with brushes, where the mechanical commutation of the rotor coils generate a similar square wave.) Pulse width modulation drive is sometimes added to the control the speed of the motor by turning off the power

during parts of a cycle (to reduce power). There is no teaching of the distinction between the required drive of AC induction motors and the drive of BLDC motors.

In regard to claim 27, paragraphs 37-40 teach the function of the averaging transformer as 1) an added inductance and 2) a low pass filtering effect where the energy components at higher frequencies (harmonics) are attenuated. These harmonics are an unwanted characteristic of the synthesis of the sinusoidal AC voltage used to power an induction motor. Since the typical drive of BLDC motor more closely resembles a commutated DC voltage (square wave), harmonics of the sort generated by synthesizing a sinusoidal AC voltage are not present. Given this detail the insertion of the averaging transformer between the inverter and a DLDC motor has not been shown to have a useful value. The differences in the ripple currents and methods for limiting the same in the drive of AC induction motors and BLDC motors are not described. Although a coreless, brushless motor may have very low inductance and be affected by ripple currents, there is no teaching of the ripple present in the typical inverter drive of a BLDC motor where no additional induction is added.

Using the available disclosure one of ordinary skill in the art of motor controls could not make or use the invention as described in claims 26, and 27.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6, 8, 11, 12-17, 19, 22, 25 and 29 rejected under 35 U.S.C. 102(b) as being patented in this country by Yamamoto (5,852,554).

As regards claim 1, Yamamoto discloses a polyphase inverter (his abstract references a unit suitable for driving a three-phase induction motor) comprising:

a first conductor, Figure 1 references his positive DC supply voltage;

a second conductor, Figure 1 references his negative DC supply voltage;

M phases, each phase comprising N inverters, each inverter comprising two inverter inputs, an inverter output (Figure 1 references three inverters per phase, each inverter having two inputs and he discloses 2 or more (N) in his specifications), a first node coupled to the first conductor and a second node coupled to the second conductor (Figure 1); and

M transformers, each transformer comprising N transformer inputs and a transformer output, each of the N inverter outputs from each phase coupled to each of the N inputs of an associated one of the M transformers (Figures 1, 2 and 3.). Yamamoto discloses Ms and Ns as two or more.

As regards claim 2, Yamamoto discloses in Figure 1 the case of M=3.

As regards claim 3, Yamamoto discloses in Figure 1 the case of a circuit driving an electric motor.

As regards claim 4, Yamamoto discloses in Figure 1 the case of N=3.

As regards claim 5, Yamamoto discloses in Figure 1 the case of M=3 and N=3.

As regards claim 6, Yamamoto discloses (column, line 14) the case of inverters composed of insulated gate bipolar transistors (IGBTs).

As regards claim 8, Yamamoto discloses (column 3, lines 30-35) the case of transformers composed of N cores (multiple juxtaposed legs or a plurality of cores).

As regards claim 11, Yamamoto discloses in Figure 1 of his disclosure the case of a logic circuit used to drive the inputs of the inverters.

As regards claim 12, Yamamoto discloses in the abstract of his disclosure the case of the logic circuit used to provide PWM signals to drive the inputs to the inverters.

As regards claim 13, this features all the claims of claim 1 plus a logic circuit and subphases per each N inverter pair. This is the case of claim 11, which is dependent on claim 1. Yamamoto discloses all these features in his Figure 1.

As regards claim 14, Yamamoto discloses in Figure 1 the case of M=3.

As regards claims 15 and 16, Yamamoto discloses in Figure 1 the case of M=3 and the case of a circuit driving an electric motor.

As regards claim 17, Yamamoto discloses (column, line 14) the case of inverters composed of insulated gate bipolar transistors (IGBTs).

As regards claim 19, Yamamoto discloses (column 3, lines 30-35) the case of transformers composed of N cores (multiple juxtaposed legs or a plurality of cores).

As regards claim 22, Yamamoto discloses in Figure 1 the case of a circuit driving an electric motor of M phases.

As regards claim 25, this features all the claims of claim 1 plus an M phase electric motor. This is the case of claim 3, which is dependent on claim 1. Yamamoto discloses all these features in his Figure 1.

As regards claim 29, this features all the claims of claim 25 plus an M phase electric motor, wherein M is 3. This is the case of claim 3, which is dependent on claim 1. Yamamoto discloses all these features in his Figure 1.

Claims 7 is rejected under 35 U.S.C. 102(b) as being patented in this country by McMurray (5,446,643).

As regards claim 7 as dependent on claim 1, McMurray (Figure 1B) discloses a circuit with all the features of claim 1 and an embodiment of the inverters composed of metal-oxide-semiconductor field effect transistors (column 16, lines 21-24).

As regards claim 1, McMurray discloses a polyphase inverter (Figure 1B) comprising:

a first conductor, Figure 1B references his positive DC supply voltage;

a second conductor, Figure 1B references his negative DC supply voltage;

M phases, each phase comprising N inverters, each inverter comprising two inverter inputs, an inverter output (Figure 1B references three inverters per phase, each inverter having two inputs and he discloses 2 or more (N) in his specifications), a first node coupled to the first conductor and a second node coupled to the second conductor (Figure 1B); and

M transformers, each transformer comprising N transformer inputs and a transformer output, each of the N inverter outputs from each phase coupled to each of the N inputs of an associated one of the M transformers (Figures 11 shows each phase coupled to N inputs and M outputs.). McMurray describes multiple parallel phase legs in column 15

Claims 10, 18, and 21 are rejected under 35 U.S.C. 102(b) as being patented in this country by Stacy (5,337,227).

As regards claim 10 as dependent on claim 1, Stacy in Figure 5 discloses a circuit with all the features of claim 1 and the case wherein each of the M transformers comprises a plurality of center-tapped transformers.

As regards claim 1, Stacy discloses a polyphase inverter (Figure 5) comprising:

a first conductor, Figure 5 references his positive DC supply voltage;

a second conductor, Figure 5 references his negative DC supply voltage;

M phases, each phase comprising N inverters, each inverter comprising two inverter inputs, an inverter output (Figure 5 references eight inverters per phase, each inverter having two inputs and he discloses 2 or more (N) in his specifications), a first node coupled to the first conductor and a second node coupled to the second conductor (Figure 5); and

M transformers, each transformer comprising N transformer inputs and a transformer output, each of the N inverter outputs from each phase coupled to each of the N inputs of an associated one of the M transformers (Figures 5 shows each phase coupled to N inputs and M outputs.).

As regards claim 18 as dependent on claim 13, Stacy in Figure 5 discloses a circuit with all the features of claim 13 and the case (column 1, line 25) wherein the transistors comprise metal-oxide-semiconductor field effect transistors.

As regards claim 13, this features all the claims of claim 1 plus a logic circuit and subphases per each N inverter pair. This is the case of claim 11, which is dependent on

claim 1. Stacy describes subphases in terms of successively staggered waveforms in the abstract.

As regards claim 21 as dependent on claim 13, Stacy in Figure 5 discloses a circuit with all the features of claim 13 and the case wherein each transformer comprises at least one center-tapped transformer.

As regards claim 13, this features all the claims of claim 1 plus a logic circuit and subphases per each N inverter pair. This is the case of claim 11, which is dependent on claim 1. Stacy describes subphases in terms of successively staggered waveforms in the abstract.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 9 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamato and further in view of Hogan (6,166,531).

Claim 9 discloses the invention of claim 1 with M transformers comprising N toroids.

In the case of claims 9, all the claims of the parent claim, 1, are disclosed by Yamamato. In the case of claim 20, all the claims of the parent claim, 13, are disclosed by Yamamato. Yamamato does not teach the use of toroidal transformers.

A toroid is a species of transformer as are single core, ferite, C-type EI, and multi-legged laminated cores. Each of the species of transformers may be wired as electrically similar circuits. In many circuits over a suitable frequency range a transformer of one species can be substituted for a transformer of another species.

Hogan teaches (columns 10 and 11) the interchangeable use of a toroidal, C, ferrite cores and EI laminated transformers.

It would have been an obvious to one of ordinary skill in the art to select a toroid type transformer as taught by Hogan in place of the type of transformer in Hogan because of the interchangeability of articles.

Claims 26, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Baum (6,356,043) and further in view of Yamamoto.

In the case of claim 26, the inventor features the use of multiple inverters pairs per phase used to drive a polyphase, brushless DC motor, where the plurality of inverter power supplies are coupled to each phase of the motor by transformers.

Baum discloses the use of multiple inverters pairs per phase used to drive a polyphase brushless DC motor, where the plurality of inverter power supplies are directly coupled to each phase of the motor. Baum does not teach the use of transformers for coupling the inverters to the motor.

Yamamoto teaches the use of transformers between the inverter power supplies and the drive phases of an AC induction motor. It is well known in the art that inverters introduces various types of ripple into the outputs which can be a factor in the driving of

DC brushless motors and the driving of AC induction motors. Inductors and transformers have been shown to attenuate some of the ripple content.

One of ordinary skill in the art would have been motivated to select an inductive element such as a transformer to couple a multi-stage, polyphase power supply to a DC brushless motor as taught by Yamato into the circuit of Baum as a means to attenuate some of the ripple content in the signal drive the motor.

Conclusion

In summary, all 29 claims have either objections and/or a statutory basis for rejection. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure are disclosed in the Form 1449. These references should be considered in responses to this letter of non-final rejection of claims.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Robert W. Horn whose telephone number is 571-272-8591. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David S. Martin can be reached on 571-272-2107. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

rwh
April 4, 2005

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